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Original Article

Altruistic behavior and cooperation: the role of intrinsic expectation when reputational information is incomplete

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Abstract: Altruistic behavior is known to be conditional on the level of altruism of others. However, people often have no information, or incomplete information, about the altruistic reputation of others, for example when the reputation was obtained in a different social or economic context. As a consequence, they have to estimate the other's altruistic intentions. Using an economic game, we showed that without reputational information people have intrinsic expectations about the altruistic behavior of others, which largely explained their own altruistic behavior. This implies that when no information is available, intrinsic expectations can be as powerful a driver of altruistic behavior as actual knowledge about other people's reputation. Two strategies appeared to co-exist in our study population: participants who expected others to be altruistic and acted even more altruistically themselves, while other participants had low expected altruism scores and acted even less altruistically than they expected others to do. We also found evidence that generosity in economic games translates into benefits for other social contexts: a reputation of financial generosity increased the attractiveness of partners in a social cooperative game. This result implies that in situations with incomplete information, the fitness effects of indirect reciprocity are cumulative across different social contexts.

Keywords: altruism, competitive altruism, conditional cooperation, Dictator Game, reputation building.

Introduction

Altruism among unrelated individuals is fascinating because its widespread occurrence is difficult to understand from the principles of natural selection. Several theories have suggested that even when altruistic acts are costly, altruists can gain if they are reciprocated directly or indirectly (Trivers, 1971). Direct reciprocity occurs when the receiver of an

altruistic act in turn provides benefits for the individual that has acted altruistically (Axelrod, 1984). Indirect reciprocity involves altruism towards recipients, but the reciprocal benefits are provided by others than the recipients (Alexander, 1987; Roberts, 1998). A particular human prosocial trait that facilitates maintenance of altruism is strong reciprocity, which predisposes people to cooperate with others and punish non-cooperators, even when this behavior cannot be justified in terms of extended kinship or reciprocal altruism (Gintis, 2000). Theoretical models have shown repeatedly that direct, indirect, and strong reciprocity can overcome the short-term costs of altruistic behavior and, under specific conditions, lead to long term fitness advantages of generous behavior (Fishman, 2003; Leimar and Hammerstein, 2001; Lotem, Fishman, and Stone, 1999; Mohtashemi and Mui, 2003; Nowak and Sigmund, 1998a, b).

The main mechanism underlying indirect reciprocity is thought to be reputation building or image scoring. Individuals that act altruistically will earn a good reputation that will be repaid in future interactions (Alexander, 1987). Experimental economic games have shown that when potential partners know another's past behavior, they use this reputational information to modify their future social interactions (Barclay, 2004; Milinski, Semmann, and Krambeck, 2002; Wedekind and Braithwaite, 2002; Wedekind and Milinski, 2000). In economic games with repeated social interactions, generous players benefit in the long-term because they receive higher payoffs from other participants (Wedekind and Braithwaite, 2002). Variation among individuals in the tendency to donate money altruistically may also affect their chances of being chosen as cooperative partner in future economic interactions, since the most generous people are preferred as cooperative partners (Barclay, 2004). Hence, the benefits of altruistic behavior depend not only on the altruistic act itself, but also on how this behavior ranks compared to the altruism of other competitors.

However, in reality people seldom have complete information about the altruistic behavior of others. For example, when individuals are amongst unknown people or when the reputation of others concerns altruism in a different social or economic context, the level of generosity of potential competitors is unknown. Since economic games show that the "value" of an altruistic act is dependent on the frequency and magnitude of generosity of other people, not knowing the altruistic reputation of others significantly hampers the decision about the optimal level of generosity (Mitzkewitz and Nagel, 1993; Rotemberg, 2008). Similarly, the choice for cooperative partners depends on the partners' level of altruism, but scarce knowledge about the altruistic reputation of potential partners prevents an optimal decision about cooperation. Instead, incomplete information will force people to rely on their intrinsic expectation of altruism of others, which is likely to be inaccurate due to widespread variation in generosity among humans (Camerer and Hogarth, 1999; Forsythe, Horowitz, Savin, and Sefton, 1994). Alternatively, humans may rely on alternative cues if available, such as other types of social behavior such as a person's faithfulness and loyalty to friends (Pradel, Euler, and Fetchenhauer, 2009). It is unknown to what extent generosity in economic games translates to trust in other types of cooperative behavior.

The present study investigates decision-making when incomplete information is available about the altruistic behavior of others. We test two hypotheses: a) when no information about altruistic reputation is available, an individual's expectation about other people's altruism is correlated to their own level of generosity, and b) an altruistic

reputation obtained in an economic game increases acceptance as a partner in a social dyadic task. We used the Dictator Game in combination with a questionnaire to measure observed and expected generosity of participants. Subsequently, participants played a dyadic cooperative game, in which they received fictitious information about the Dictator Game decision of their prospective cooperative partner.

Materials and Methods

Participants and anonymity

The 633 participants in our study consisted of 198 males (average age 22.1 ± *SD* 2.7 years) and 435 females (average age 21.5 ± *SD* 2.7 years) from various universities in the Netherlands. They were recruited via university e-mailing lists to visit our internet site where they were asked to fill out an online questionnaire. Therefore participation was anonymous and there was no contact between experimenters and participants. All participants gave informed consent. The Dictator Game (see below) was played by all participants while a random subset of 240 participants (69 males and 171 females) performed the cooperative task. To contain costs, we did not award all participants the money they accrued. Instead, we informed them that one randomly selected participant would receive the amount he or she accrued. Students could not participate multiple times, because separate from filling in the questionnaire, they left personal details to be able to participate in the lottery, and if these details were already present in our database their questionnaire was not entered in the database.

Game play

In the online questionnaire the participants were asked for their gender and age. They received written instructions for the Dictator Game in which they could choose to share €60 by donating half to an anonymous person or to keep the entire sum to themselves. After they had made their decision, they were asked to estimate the proportion of participants that would share the money (by choosing from 11 categories ranging from 0-100% of participants sharing), which is referred to subsequently as expected altruism.

A random subset of the participants also played a dyadic cooperative game. They received instructions about a fictitious situation in which they could choose to work alone or cooperate with an unknown peer student to pass a course exam. Participants were told that if they chose to work together with the unknown student, the workload of the course would be halved because the work could be split among them. Hence, they would spend only half the time on course attendance compared to working alone. However, it was made clear to the participants that cooperation contained a risk; because if their partner defected, their chances of passing the course exam would be strongly reduced. On the other hand, if they chose not to cooperate they would have to spend full time on the course, yet their chances of passing the exam would increase. No information about the sex of the student was provided. The participants were asked to make a single decision and were given the possibility to write a motivation for their choice. Also, they were asked to rank themselves on a scale from 1-7 to indicate general willingness to collaborate with other people.

The experimental design of the cooperative game included three treatments by variation in the written information for the cooperative game. In the "No information" treatment no information was given about the peer student in the previous Dictator Game. The "Share

money" treatment included information that the peer student had shared the money in the previous Dictator Game, and the "Keep money" treatment included information that the peer student had not shared the money in the Dictator Game.

Statistics

We used logistic regression analysis to assess the association between measured characteristics of the participants (sex, age and expected altruism) and their decision to keep or share money in the Dictator Game. We also tested if the participants' altruistic behavior in the Dictator Game agreed with their expectations about altruistic behavior of others. For each category of expected altruism, the observed sharing percentage was calculated and tested against a binomial distribution with the percentage expected altruism as the probability parameter.

We also performed a logistic regression on the decision to collaborate in the dyadic cooperative game. The backward stepwise procedure was used to obtain the best minimal model for the independent variables age, sex, general willingness to collaborate, expected altruism, and the participant's own decision in the Dictator Game. The three treatments with manipulated information provided about the prospective partner's altruism were included in the analysis as categorical variables using the indicator contrast method. To explore if the three treatment levels needed to be maintained separately, alternative models were run with two treatment levels pooled. The significance of the resulting change in goodness of fit was assessed by comparing the change in deviance (-2 log likelihood) of the alternative models with the chi-square distribution with $df = 1$ (Hardy and Field, 1998). All tests were run in SPSS 14.0.

Results

3.1 Dictator Game

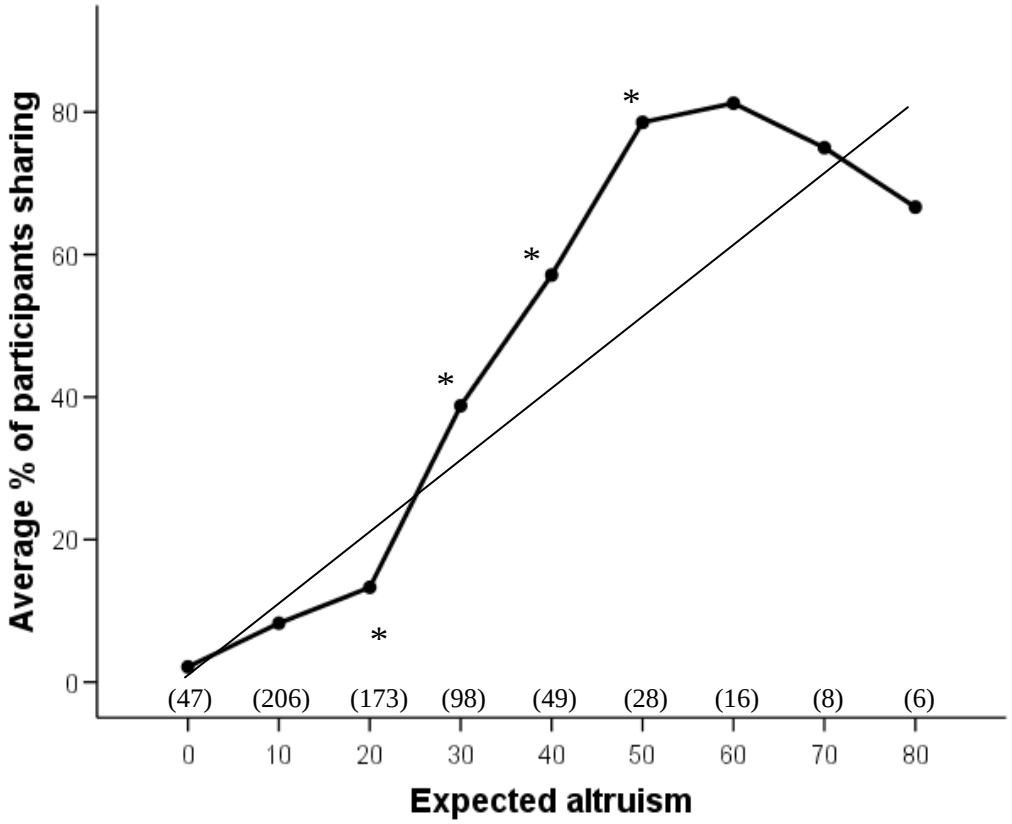
Out of all the participants in the Dictator Game, 24.2% chose to share the money, hence acting altruistically. A logistic regression analysis showed that sex and age of the participants did not influence the frequency of altruistic behavior (see Table 1). There was substantial variation in the expected altruism scores of participants. Most participants had expected altruism scores of 10%, 20%, or 30% (respectively 32.5%, 27.3%, and 15.5% of participants). Since the actual sharing percentage in the Dictator Game was 24.2%, only around a third of the participants had a realistic perception of altruistic behavior of their peers, nearly 40% underestimated the incidence of altruism, and almost a third overestimated the frequency of altruism.

In fact, expected altruism was the only variable in the logistic regression that explained a significant proportion of the observed variation in sharing behavior among our participants (see Table 1). Participants with low expected altruism scores were less likely to share than those participants with high expected altruism scores. The percentage of

Table 1. Logistic regression of the effect of sex, age and expected altruism of participants on the decision to share money in the Dictator Game.

	B	*S.E.*	Wald statistic	*df*	*p*-value
Sex	-0.077	0.24	0.11	1	0.742
Age	-0.038	0.04	0.86	1	0.355
Expected altruism	0.792	0.08	106.03	1	**<0.001**

Figure 1. The relationship between expected altruism and the average percentage of participants sharing their money in the Dictator Game (thick line). If participants acted according to their own expectations, the percentage sharing would equal expected altruism (thin line).



Asterisks indicate where observed sharing behavior deviates significantly from expected altruism (*: $p < 0.05$). Number in brackets represents sample size (Two participants had expected altruism scores of 90%, but these are not shown because of the low sample size).

Table 2. Logistic regression of the decision to collaborate in the dyadic cooperative game.

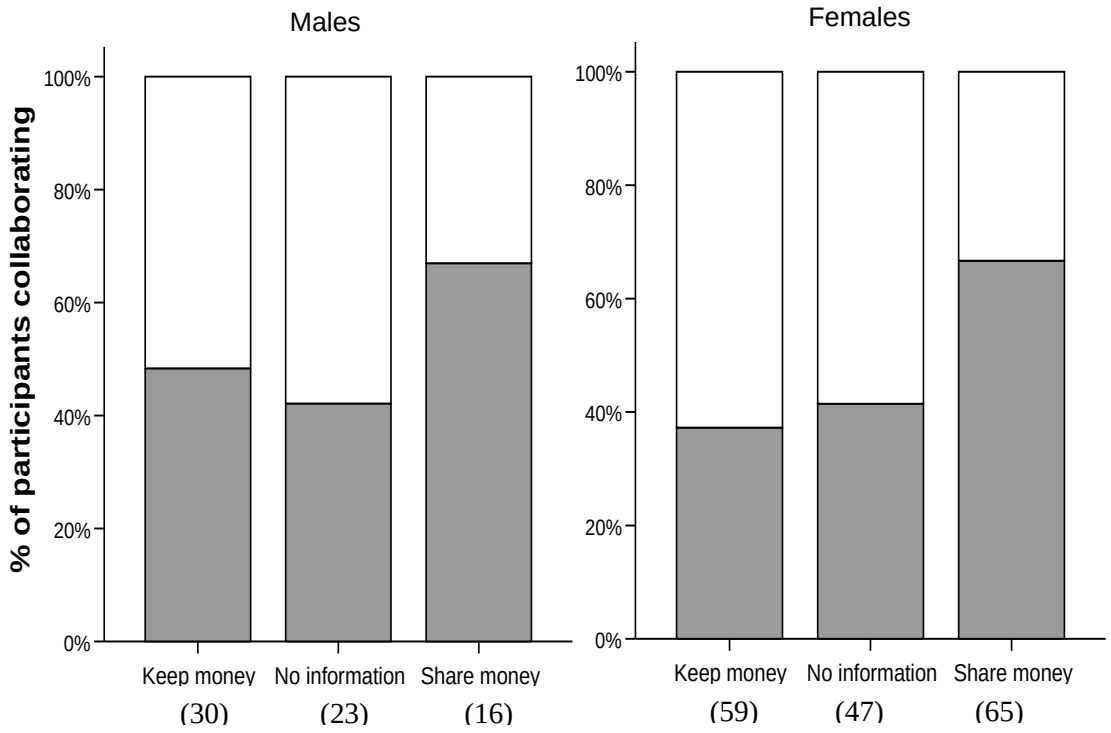
	B	*S.E.*	Wald statistic	*df*	*p*-value
Sex	-1.197	0.32	14.38	**1**	**<0.001**
Information about partner's altruism				1	
"Keep money"			13.41	2	**0.001**
"No Information"	0.031	0.34	<0.01	1	0.976
"Share money"	1.106	0.57	9.31	1	**0.001**

participants choosing to share did not increase linearly with their own expected altruism scores. Participants with low expected altruism scores shared on average somewhat less frequently than their own expectations of altruism. On the other hand, the participants with high expected altruism scores behaved on average even more altruistically than they expected others to do (see Figure 1).

3.2 Cooperative game

In total, 51.3% of the participants replied positively to the proposed collaboration. The best model to explain variation in the decision to collaborate contained two independent variables: the sex of the participant and the information provided about the prospective partners' altruism (see Table 2). The independent variables age, general willingness to collaborate, expected altruism, and the participant's own decision in the Dictator Game did not contribute significantly to the model. The analysis showed that females were less willing to collaborate than males (44.4 % vs 68.1% resp.). Independent of sex, if participants were led to believe that the unknown peer student had shared altruistically in the Dictator Game they were significantly more likely to agree to collaboration (Figure 2, Table 2). Further reduction of the model resulted in significant loss of power if the "Share money"-treatment was pooled with any of the other treatments (Deviance values increased from 307.2 to 316.9 ($p = 0.002$) and 318.7 ($p < 0.001$), resp). However, no explanatory power was lost if the "No information"-treatment and "Keep money"-treatment were pooled (Deviance value changed from 307.2 to 307.2 ($p = 0.92$)). In other words, participants were equally likely to collaborate with documented non-altruistic partners as with unknown partners, but had a higher likelihood of collaboration with documented altruistic partners.

Figure 2. The average percentage of male and female participants collaborating in the dyadic cooperative game. Participants received different information about the altruistic reputation of their potential partners (Keep money, No information, Share money). Grey bars represent percentage collaborating, open bars represents percentage not collaborating.



Number in parentheses represents sample size.

Discussion

Two main findings result from our study on human altruistic and cooperative decisions when reputational information is incomplete. First, our data showed that in the Dictator Game individual variation in altruistic behavior was solely explained by intrinsic expectations about the prevalence of altruism in other people. Second, we demonstrated that positive reputational information is transferable across different domains of altruistic behavior: information about altruistic behavior in an economic game enhanced the probability of initiating collaborative social interactions. Surprisingly, collaboration with partners of unknown reputation and negative reputation was equally infrequent. Such lack of distinction suggests that people are cautious to engage in collaborations with unfamiliar partners.

Our findings showed that roughly a quarter of the participants shared their endowment. Despite the fact that our participants did not use actual money, experiments that did use real money payoffs have found a similar percentage of participants giving away half of their endowment (Knafo et al., 2007). Previous work has shown that the average amount offered when money is hypothetical is remarkably similar to when real money is at stake (Ben-Ner,

Kramer, and Levi, 2008; Cameron 1999; Gillis and Hettler, 2007). Also, the stakes do not seem to affect the amount of money offered (Cameron, 1999; Hoffman, McCabe, and Smith, 1996). Hence it is reasonable to assume that our results were not biased due to our reward system, which justifies a comparison with other work using real money.

Furthermore, the behavior of subjects in the Dictator Game is known to be strongly influenced by the experimental context in which the decisions are made. The anonymity and observability of the participant's decisions are particularly vital to the level of generosity displayed, because reputational concerns are known to be a powerful force in driving altruistic behavior (Bateson, Nettle, and Roberts, 2006; Burnham, 2003; Haley and Fessler, 2005). In our experiment, participants filled out an anonymous internet questionnaire so no interaction with the experimenters took place. Therefore, the results were not influenced by overt factors allowing reputation management, or by unconscious inputs that determine the sense of anonymity.

We predicted that in the absence of reputational information of competitors, altruistic behavior should be more prevalent among those participants with high intrinsic expectations of altruism of others. Indeed, higher intrinsic expectations about the degree of altruism of others were significantly associated with more generosity. These results in themselves are insufficient to demonstrate reciprocity in altruism, as the reported level of expected altruism could have been directly related to the level of altruism the participants themselves had displayed in the Dictator Game (cf. Orbell and Dawes, 1991). However, our findings are consistent with previous studies on conditional cooperation in donation strategies. These show that people's donations are positively correlated with donations of other contributors, demonstrating that individuals are only willing to donate more if they know that others do so. (Croson, 2007, Fischbacher, Gächter, and Fehr, 2001, Keser and van Winden, 2000).

Additional evidence for the role of expectations in conditional cooperation is found in experiments using public goods games, in which condition dependence seems to exist if people only expect others to contribute more to the public good (Croson, 2007, Wit and Wilke, 1992). It has been suggested that the similarity between participants' own contributions and their expectations about others is due to concerns about free-riding (Kurzban, McCabe, Smith, and Wilson, 2001). The novelty of our results is that the Dictator Game does not involve free-riding because it is a one shot interaction and there are no consequences of the other participant's generosity on one's own earnings. This implies that when no information is available, expectations can be a powerful a driver of altruistic behavior independent of free rider considerations.

In fact, participants who expected others to be altruistic acted even more altruistically themselves (see Figure 1). Our findings therefore partly support the competitive altruism model (Roberts, 1998), which predicts that individuals aim to be more altruistic than others in order to be chosen for further cooperative interactions (Barclay and Willer, 2007). Our data confirm this key prediction because the participants with high expected altruism scores donated money significantly more frequently than they expected others to do (see Figure 1), hence acting more altruistically than others. Yet at the same time, we found that participants with low expected altruism scores acted even less altruistically than they expected others to do. One explanation is that these participants followed a free-rider strategy, but it is not clear why this strategy was confined to participants with low expected altruism scores. Another explanation has to do with the fact that prosocial behavior can

elicit anti-social punishment (Herrmann, Thoni, and Gachter, 2008), i.e. punishment directed towards people who are more altruistic than the punisher. Although the Dictator Game does not involve a possibility for punishment, antisocial punishment in other economic games is negatively correlated to social norms of cooperation and can severely limit altruistic behavior (Herrmann et al., 2008).

Obviously, it remains to be tested whether this self-reported measure of expected altruism is stable over individuals' lifetimes. It is probably reasonable to assume that the level of expected altruism is the result of the combined influence of genes and environment, as is the case for many behavioral traits. Adjustment of expected altruism may occur in response to the level of altruism experienced in other encounters (Barclay, 2004; Milinski et al., 2002; Sefton, Shupp, and Walker, 2007). Also, quantitative genetic studies have shown that traits involved in altruistic behavior in economic games are heritable and suggest common environment to have a very modest role as a source of phenotypic variation (Cesarini et al., 2008; Wallace, Cesarini, Lichtenstein, and Johannesson, 2007). Recently, the level of generosity in the Dictator Game has been demonstrated to be associated with genetic polymorphism in the length of the RS3 repeat in the AVPR1a promoter region (Knafo et al., 2007). Future research is required to determine if variation in expectations of altruism can also be characterized by this common genetic polymorphism.

We also predicted that the willingness to collaborate in a social dyadic task would depend on the altruistic reputation obtained in economic games (Kahneman, Knetsch, and Thaler, 1986; Trivers, 1971). In our study, reputational information was manipulated by including information about previous Dictator Game decisions, which is potentially susceptible to demand characteristics, i.e. participants may guess that this information should influence their disposition (Bardsley, 2008; Orne, 1962). However, our results showed that the decision to collaborate was only affected by a positive reputation of the potential partner, not by negative information, which may indicate that human image scoring is more geared toward positive images. Public goods games have demonstrated repeatedly that refusal to show altruistic behavior is punished by other players, indicative of an aversion to cooperate with non-altruists (Egas and Riedl, 2008; Fehr and Gächter, 2000). It is remarkable that when no information is available about a potential partner's reputation a similar dislike of collaboration is displayed.

The fact that a good reputation has payoffs beyond the strict context in which the reputation is obtained suggests the long-term benefits of reputation building have been greatly underestimated so far. Generosity has been considered in different contexts, including food sharing (Bird, Bird, Smith, and Kushnick, 2002; Smith, Bird, and Bird, 2003), money sharing, organ donation (Holroyd and Molassiotis, 2000; Simmons, Schimmel, and Butterworth, 1993), and time spent in public office (Price, 2003), and can be indirectly rewarded by e.g. economic payment, sexual rewards, cooperative relationships and attributed social status and political support. Measuring the cumulative fitness effects of indirect reciprocity across different social contexts may be a prohibitively difficult undertaking, but may be essential to understand the evolutionary forces promoting altruistic behavior.

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References

Axelrod, R. (1984). *The evolution of cooperation.* New York, Basic Books

Alexander, R. D. (1987). *The biology of moral systems.* New York, Aldine de Gruyter.

Barclay, P. (2004). Trustworthiness and competitive altruism can also solve the "tragedy of the commons". *Evolution and Human Behavior, 25,* 209-220.

Barclay, P., and Willer, R. (2007). Partner choice creates competitive altruism in humans. *Proceedings of the Royal Society of London B, 274,* 749-753.

Bardsley, N. (2008). Dictator game giving: altruism or artefact? *Experimental Economics, 11,* 122-133.

Bateson, M., Nettle, D., and Roberts, G. (2006). Cues of being watched enhance cooperation in a real-world setting. *Biology Letters, 2,* 412-414.

Ben-Ner, A., Kramer, A., and Levi, A. (2008). Economic and hypothetical dictator game experiments: Incentive effects at the individual level. *Journal of Socio-Economics, 37,* 1775-1784.

Bird, R. B., Bird, D. W., Smith, E. A., and Kushnick, G. C. (2002). Risk and reciprocity in Meriam food sharing. *Evolution and Human Behavior, 23,* 297-321.

Burnham, T. C. (2003). Engineering altruism: A theoretical and experimental investigation of anonymity and gift giving. *Journal of Economic Behavior and Organization, 50,* 133-44.

Camerer, C. F. and Hogarth, R. M. (1999). The effects of financial incentives in experiments: A review and capital-labor-production framework. *Journal of Risk and Uncertainty, 19,* 7-42.

Cameron, L. A. (1999). Raising the stakes in the ultimatum game: Experimental evidence from Indonesia. *Economic Inquiry, 37,* 47-59.

Cesarini, D., Dawes, C. T., Fowler, J. H., Johannesson, M., Lichtenstein, P., and Wallace, B. (2008). Heritability of cooperative behavior in the trust game. *Proceedings of the National Academy of Sciences, 105,* 3721-3726.

Croson, R. T. A. (2007). Theories of commitment, altruism and reciprocity: evidence from linear public goods games. *Economic Inquiry, 45,* 199–216.

Egas, M., and Riedl, A. (2008). The economics of altruistic punishment and the maintenance of cooperation. *Proceedings of the Royal Society of London B, 275,* 871-878.

Fehr, E., and Gächter, S. (2000). Cooperation and punishment in public goods experiments. *American Economic Review, 90,* 980-994.

Fischbacher, U., Gächter, S., and Fehr, E. (2001). Are people conditionally cooperative? Evidence from a public goods experiment. *Economics Letters, 71,* 397–404.

Fishman, M. A. (2003). Indirect reciprocity among imperfect individuals. *Journal of Theoretical Biology, 225***,** 285-292.

Forsythe, R., Horowitz, J. L., Savin, N. E., and Sefton, M. (1994). Fairness in Simple Bargaining Experiments. *Games and Economic Behavior, 6,* 347-369.

Gillis, M. T., and Hettler, P. L. (2007). Hypothetical and real incentives in the ultimatum game and Andreoni's public goods game: an experimental study. *Eastern Economic Journal, 33,* 491-510.

Gintis, H. (2000). Strong reciprocity and human sociality. *Journal of Theoretical Biology, 206,* 169-179.

Haley, K. J., and Fessler, D. M. T. (2005). Nobody's watching? Subtle cues affect generosity in an anonymous economic game. *Evolution and Human Behavior, 26,* 245-256.

Hardy, I. C. W., and Field, S. A. (1998). Logistic analysis of animal contests. *Animal Behaviour, 56,* 787-792.

Herrmann, B., Thoni, C., and Gachter, S. (2008). Antisocial punishment across societies. *Science, 319,* 1362-1367.

Hoffman, E., McCabe, K., and Smith, V. L. (1996). On expectations and the monetary stakes in ultimatum games. *International Journal of Game Theory, 25,* 289-301.

Holroyd, E., and Molassiotis, A. (2000). Hong Kong Chinese perceptions of the experience of unrelated bone marrow donation. *Social Science and Medecine, 51,* 29-40.

Kahneman, D., Knetsch, J., and Thaler, R. (1986). Fairness and the assumptions of economics. *Journal of Business, 59,* S285-S300.

Keser, C., and Van Winden, F. (2000). Conditional cooperation and voluntary contributions to public goods. *Scandinavian Journal of Economics, 102,* 23-39

Knafo, A., Israel, S., Darvasi, A., Bachner-Melman, R., Uzefovsky, F., Cohen, L., ... Ebstein, R. P. (2008). Individual differences in allocation of funds in the dictator game associated with length of the arginine vasopressin 1a receptor RS3 promoter region and correlation between RS3 length and hippocampal mRNA. *Genes, Brain and Behaviour, 7,* 266-275.

Kurzban, R., McCabe, K., Smith, V. L., and Wilson, B. J. (2001). Incremental commitment and reciprocity in a real-time public goods game. *Personality and Social Psychology Bulletin, 27,* 1662-1673.

Leimar, O., and Hammerstein, P. (2001). Evolution of cooperation through indirect reciprocity. *Proceedings of the Royal Society of London B, 268,* 745-753.

Lotem, A., Fishman, M. A., and Stone, L. (1999). Evolution of cooperation between individuals. *Nature, 400,* 226-227.

Milinski, M., Semmann, D., and Krambeck, H. J. (2002). Reputation helps solve the 'tragedy of the commons'. *Nature, 415,* 424-426.

Mitzkewitz, M., and Nagel, R. (1993). Experimental results on ultimatum games with incomplete information. *International Journal of Game Theory, 22,* 171–198.

Mohtashemi, M., and Mui, L. (2003). Evolution of indirect reciprocity by social information: the role of trust and reputation in evolution of altruism. *Journal of Theoretical Biology, 223,* 523-531.

Nowak, M. A., and Sigmund, K. (1998a). The dynamics of indirect reciprocity. *Journal of Theoretical Biology, 194,* 561-574.

Nowak, M. A., and Sigmund, K. (1998b). Evolution of indirect reciprocity by image scoring. *Nature, 393,* 573-577.

Orbell, J., and Dawes, R. M. (1991). A "Cognitive Miser" theory of cooperators' advantage.

The American Political Science Review, 85, 515-528.

Orne, M. T. (1962). On the social psychology of the psychological experiment: with particular reference to demand characteristics and their implications. *American Psychologist, 17,* 776–783.

Pradel, J., Euler, H. A., and Fetchenhauer, D. (2009) Spotting altruistic dictator game players and mingling with them: the elective assortation of classmates. *Evolution and Human Behavior, 30,* 103-113.

Price, M. E. (2003). Pro-community altruism and social status in a Shuar village. *Human Nature, 14,* 191-208.

Roberts, G. (1998). Competitive altruism: from reciprocity to the handicap principle. *Proceedings of the Royal Society of London B, 265,* 427-431.

Rotemberg J. J. (2008). Minimally acceptable altruism and the ultimatum game. *Journal of Economic Behavior and Organization, 66,* 457-476

Sefton, M., Shupp, R., and Walker, J. M. (2007). The effect of rewards and sanctions in provision of public goods. *Economic Inquiry, 45,* 671-690.

Simmons, R. G., Schimmel, M., and Butterworth, V. A. (1993). The self-image of unrelated bone-marrow donors. *Journal of Health and Social Behaviour, 34,* 285-301.

Smith, E. A., Bird, R. B., and Bird, D. W. (2003). The benefits of costly signaling: Meriam turtle hunters. *Behavioural Ecology, 14,* 116-126.

Trivers, R. L. (1971). The evolution of reciprocal altruism. *Quarterly Review of Biology, 46,* 35–57.

Wallace, B., Cesarini, D., Lichtenstein, P., and Johannesson, M. (2007). Heritability of ultimatum game responder behavior. *Proceedings of the National Academy of Sciences, 104,* 15631-15634.

Wedekind, C., and Braithwaite, V. A. (2002). The long-term benefits of human generosity in indirect reciprocity. *Current Biology, 12,* 1012-1015.

Wedekind, C., and Milinski, M. (2000). Cooperation through image scoring in humans. *Science, 288,* 850-852.

Wit, A., and Wilke, H. (1998). Public good provision under environmental and social uncertainty. *European Journal of Social Psychology, 28,* 249-256.